Welding and cutting of metals

**Welding is a process which uses heat and/or pressure to join metals.
Arc welding is by far the most commonly used one in construction. Molten metal from the workpiece and a filler metal from an electrode form a common puddle which cools to form a weld.
Flame cutting is an allied process that requires the use of a torch, fuel gas, and oxygen to cut metals—primarily steel.
Shielded Metal Arc Welding (SMAW) is the most common arc welding process in construction .
SMAW uses a short length of consumable electrode which melts as it maintains the arc. Melted metal from the electrode is carried across the arc to become the filler metal of the weld.
The electrode is coated with a complex mix of chemicals that release a shielding gas such as carbon dioxide to keep air out of the arc zone and protect the weld from oxidation. The composition of the coating varies with the metal being welded.
Gas Metal Arc (GMAW) or Metal Inert Gas Welding (MIG) uses an uncoated consumable wire that is fed continuously down the middle of the welding torch. A ring-like tube around the wire transports an inert gas such as argon,helium, or carbon dioxide from an outside source to the arc zone to prevent oxidation of the weld .
Flux Cored Arc Welding (FCAW) is a variation of MIG welding. It uses a hollow consumable wire whose core contains various chemicals that generate shielding gases to strengthen the weld.
Gas Tungsten Arc Welding (GTAW) or Tungsten Inert Gas Welding (TIG)
uses a non-consumable tungsten electrode that maintains the arc and provides enough heat to join metals.Filler metal is added in the form of a rod held close to the arc. The rod melts and deposits filler metal at the weld. Shielding gases may or may not be used, depending on the metal being welded.
Oxyacetylene Welding and Cutting burns a mixture of gases—oxygen and acetylene— to generate heat for welding metals.
It’s the most common fuel gas cutting and welding used in construction. The process may also employ the use of a filler metal.
ACETYLENE
Acetylene is a mixture of carbon and hydrogen. Its stored energy is released as heat when it burns. When burned with oxygen, acetylene can produce a higher flame**

temperature (3,300°C) than any other gas used commercially. The wide flammable range of acetylene (2.5% to 81% in air) is greater than that of other commonly used gases, with consequently greater hazard.

OTHER FUEL GASES

Fuel gases for welding are used alone or with oxygen. Examples include propane, propylene, and natural gas.

Exposure to ultraviolet (UV) radiation can result directly from the arc or from a reflection off bright objects such as shiny metal or white clothing. It can cause “arc eye” when sight is not adequately protected. Eyes become watery and painful anywhere from 2 to 24 hours after exposure.The condition may last 1–5 days but is usually reversible with no lasting effects. However, repeated exposure may result in scar tissue that can impair vision.UV exposure may also cause a temporary loss of visual sharpness called “fluorescence.”

Skin reddening, commonly known as sunburn, is another hazard of UV exposure. Blistering may occur in extreme cases. Although excessive exposure to UV radiation from the sun has been linked to skin cancer, there are no reports of increased skin cancer rates from welding exposure.

The intensity of UV radiation varies with the type of welding. Generally, the higher the temperature of the welding process the higher the UV radiation.

Infrared radiation is hazardous for its thermal or heating effects. Excessive exposure to the eye may cause damage.

Visible light is released at high intensity by welding. Short-term exposure can produce “flash blindness” in which vision is affected by after-images and temporary blind spots. Repeated exposure to high-intensity visible light can produce chronic conjunctivitis, characterized by red, tearful eyes.

X-rays and gamma rays are invisible forms of ionizing radiation used to inspect welds and can be extremely damaging to unprotected parts of the body. Keep well away from any area where this type of testing is under way. X-rays are also produced during electron beam welding. The welding chamber must be completely shielded to confine the x-rays and protect the operator.

Extreme Temperatures

Very high temperatures are caused by the welding process. Gas flames may reach 3,300°C. Metals melt in a range from 260°C to 2,760°C. Welded materials, the work environment, and weather may all be sources of excessive heat which can cause muscle cramps,dehydration, sudden collapse, and unconsciousness.

Welders may suffer frostbite and hypothermia when working in extreme cold climates or with welding gases stored at temperatures as low as -268°C. Exposure to freezing temperatures can lead to fatigue, irregular breathing, lowered blood pressure, confusion, and loss of consciousness. Heat stress and cold stress are both life-threatening and, if not treated in time, can be fatal .

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